Obstetrical Care

INSTRUCTIONS FOR USE

Avalon CTS

Cordless Fetal Transducer System

FETAL MONITORING

PHILIPS

Printed in Germany 04/06

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Cordless Fetal Transducer System

M2720A

INSTRUCTIONS FOR USE

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PHILIPS

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Introduction

Who This Book is For

This book describes how to set up and use the Avalon CTS Cordless Fetal Transducer System with a fetal monitor. You should be familiar with using medical devices and with standard fetal monitoring procedures, such as fastening belts and placing transducers. **For details of installation procedures and who should carry them out, see "Installation" starting on page 3.**

The information you need to use your fetal monitor and transducers is in the fetal monitor's *Instructions for Use*. Ensure that you read and understand these instructions. Refer also to the instructions that accompany any accessories and supplies.

The exact appearance of your system, regarding details of product livery, may vary slightly from that illustrated.

For information on how to service the system, refer to the *Service Guide*.

Intended Use

When connected to a compatible fetal monitor[1], the Avalon CTS Cordless Fetal Transducer System (M2720A) lets you perform continuous, cordless patient monitoring in the antepartum period and during labor and delivery.

You can continuously monitor the fetal heart rate (FHR) non-invasively using ultrasound, or invasively by direct electrocardiogram (DECG), and the uterine activity using an external Toco transducer.

The fetal parameters are measured and transmitted continuously via radio frequency from the transducer to the base station, eliminating the need for patient cables. The fetal monitor, connected to the base station, displays and records the parameters.

All the transducers are watertight. You can continuously monitor patients in a bath or shower using the Toco (M2725A) and the Ultrasound (M2726A) transducers.

The system should only be used by, or under the direct supervision of, a licensed physician or other health care practitioner who is trained in the use of FHR monitors and in the interpretation of FHR traces.

Warnings, Cautions and Important Information

WARNING A warning alerts you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient.

CAUTION A caution alerts you to circumstances where special care is necessary for the safe and effective use of the product. Failure to observe a caution may result in minor or moderate personal injury, damage to the product or other property, and possibly in a remote risk of more serious injury.

On your system, this sign indicates that there is detailed information in this book which you must read before proceeding with your task.

In this book, graphical symbols (indicators or elements of the base station or transducer displays) depicted in this way indicate that they are blinking.

1. See “Compatible Fetal Monitors” on page 48.

2

Installation

This chapter describes how to install the Avalon CTS.

When is the Avalon CTS Customer Installable?

The Avalon CTS is intended to be customer installable under the following conditions:

- The system in its standard configuration is an “out-of-the-box”, standalone system, delivered with automatic frequency allocation, and is intended to be used with the standard antenna supplied, giving a line-of-sight operating range up to 100m/300ft.
- There are less than ten stand-alone systems in the institution.
- Connection to an antenna system is not planned.
- No other telemetry devices are used in the institution that can influence, or be influenced by, the Avalon CTS.
- There are no other sources of RF interference that influence the operation of the Avalon CTS.
- There are no country-specific regulations requiring special configuration.

Installation should be carried out by qualified technical personnel.

If you need to mount the Avalon CTS, or use the antenna extension mounting kit (M2720A Option K01), see the *Service Guide* for further details.

When Are Special Configurations Needed?

If one or more of the conditions above are not met, you need a special configuration of the Avalon CTS. For instance, you may need to:

- Set fixed frequencies when there are other telemetry systems installed in the same institution (always applies to Japan). This configuration should be carried out by qualified service personnel, either from the hospital’s biomedical department, or from Philips (see the *Service Guide*).
- Connect the Avalon CTS to an antenna system because the standard antenna is not sufficient to cover the area intended for cordless monitoring. Site preparation, antenna system design (including guidelines for mixed telemetry equipment installations), and installation should be carried out by qualified service personnel from Philips.

Installation Checklist

Use this checklist for customer installable configurations. Refer to the *Service Guide* and/or contact Philips Support for installation requirements for all other delivery configurations.

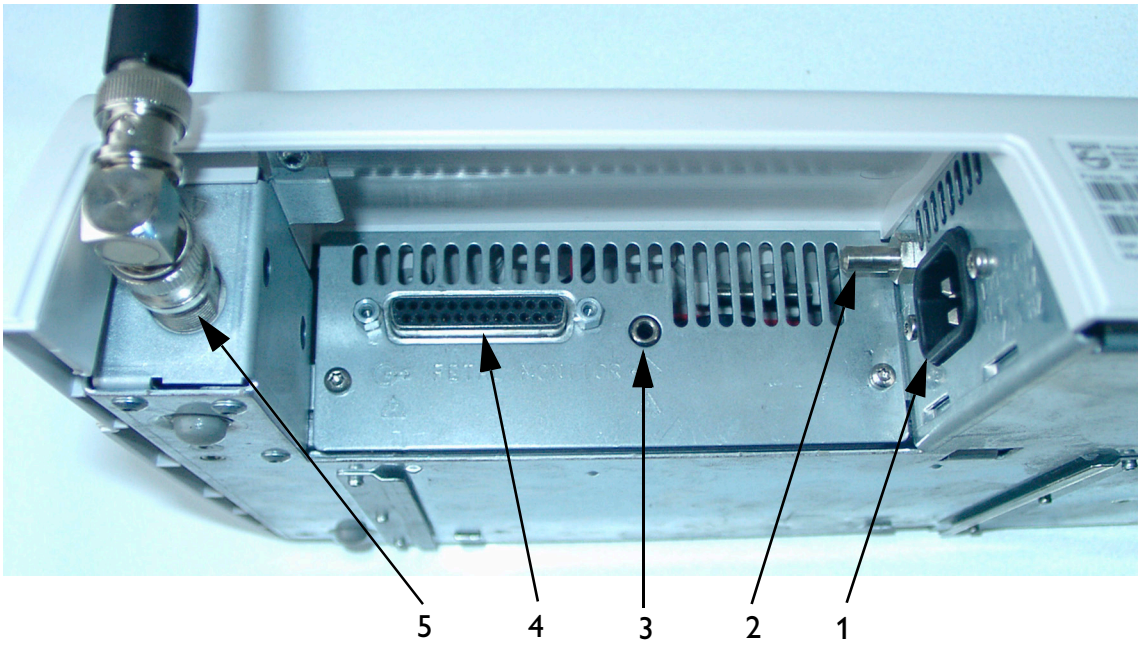
Step	Task	Check Box when Task Done
1	Perform initial inspection of delivery, unpack and check the shipment (see page 4)	❑
2	Connect and assemble the antenna (see page 5)	❑
3	Mount the monitor as appropriate for your installation (see page 6)	❑
4	Connect the base station to the fetal monitor (see page 8)	❑
5	Perform Safety Tests (see page 10)	❑
6	Connect the base station to AC mains using the supplied power cord (see page 11)	❑
7	Perform System Test as necessary (see "System Test" on page 11)	❑
8	Perform Parameter Test (see "Parameter Test" on page 36)	❑

Checking the Shipment

Unpack the system carefully. Retain the packing materials in case you need to return the system to Philips or transport your system. Use this table to check your delivery. Inspect all system components, accessories and supplies for damage before setting up your system.

System Components, Accessories and Supplies	Quantity
Base station	1
Ultrasound transducer, cordless, waterproof	1*
Ultrasound transmission gel	1 bottle*
Transducer belts, waterproof, reusable	3*
Toco transducer, cordless, waterproof	1*
ECG transducer	1 (optional)
Antenna with rectangular BNC connector	1
Interface cable, for connection to fetal monitor (depends on options ordered)	optional
Power cable	1
Service cable	1
Instructions for Use	1
Documentation CD-ROM *(Instructions for Use*, *Service Guide*, and *Service Support Tool*)	1
* Delivered quantity depends on which option you ordered.	

Setting Up the System for the First Time



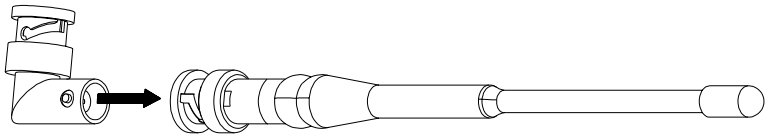
Base Station Connectors

Item	Description	
1	Standard AC mains socket.	
2	Equipotential Terminal. See “Symbols on the System” on page 50.	
3	Service Socket. 3.5 mm stereo jack for connecting the Service Support Tool (service personnel only).	
4	Interface to Fetal Monitor. Use the appropriate cable from the two listed to connect the base station to your type of fetal monitor (do not use any other cable):	M2720A option K30 - Avalon Fetal Monitor Interface Cable (M2731-60001)
		M2720A option K50 - Series 50 Interface Cable (M2720-61603)
5	Y Antenna Input. Use supplied antenna if the base station is not connected to a hospital’s antenna system.	

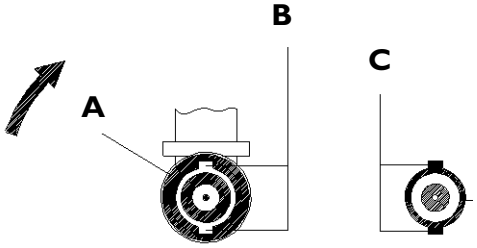
Connecting and Assembling the Standard Antenna

1 Line up the nodules on the right angle connector with the spaces on the antenna connector.

2 Push in and twist.



3 Connect the antenna[2] to the base station by turning the connector collar **(A)** at the base of the antenna so that the two spaces **(B)** are positioned at the top and bottom. These fit over the two notches **(C)** on the base station antenna socket.



4 Push the antenna onto the input socket ⋎ at the rear of the base station.

5 Turn the connector collar **(A)** clockwise until it stops. The antenna should be positioned vertically to ensure the best operating range.

To remove the antenna from the base station, turn the connector collar **(A)** anti-clockwise and pull the antenna out of the socket.

A remote antenna system, if ordered, is sent separately with its own installation documentation. Connect the remote antenna cable to the antenna socket ⋎ at the rear of the base station.

Mounting Solutions

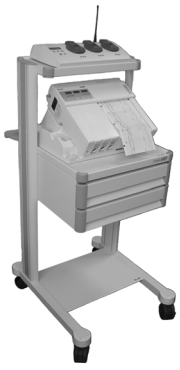
You can mount the Avalon CTS as follows:

- In a standard cart drawer. The base station with docked transducers fits into Philips Carts CL, CX and CM.

  Note: if you mount the base station in a cart or in such a way that the standard antenna cannot be attached directly to the base station, or does not provide sufficient transmission range, use the antenna extension mounting kit (M2720A Option K01).

- On a dedicated mounting shelf, forming part of the Avalon CTS mounting kit:

Avalon FM20/30 Cart with Avalon CTS mounting kit



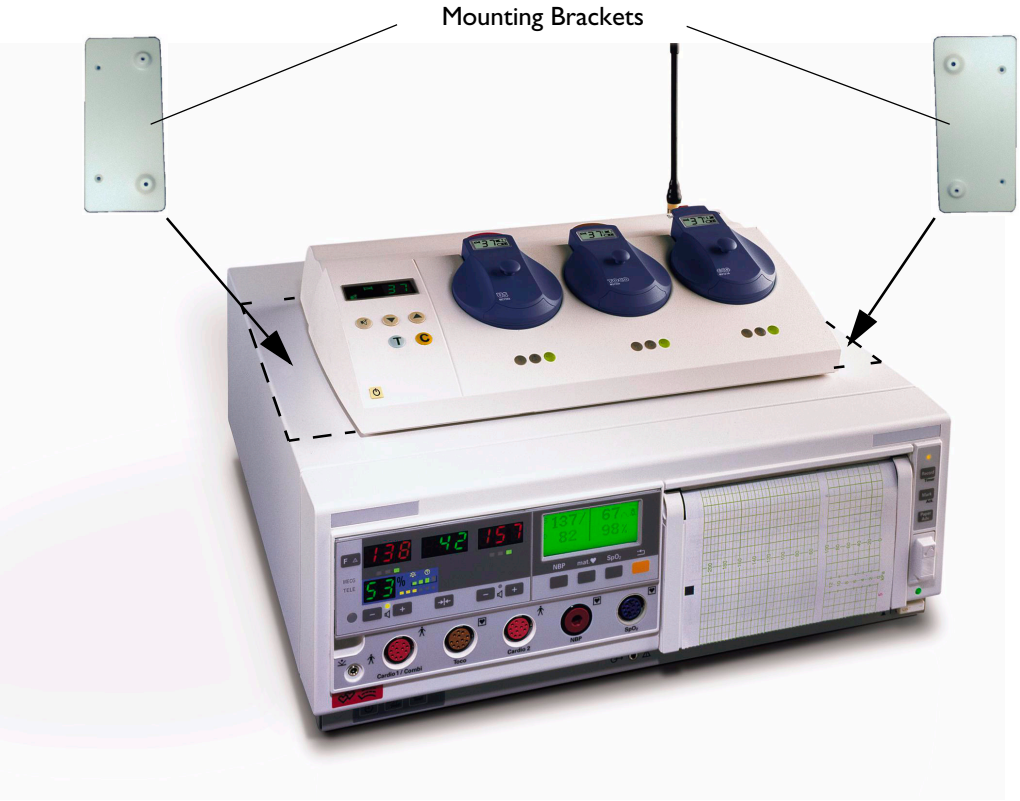
Series 50 Cart CL with Avalon CTS mounting kit

- On top of carts, desks or other flat surfaces using the mounting brackets.

2.Please note that the antenna may differ slightly from the illustration.

- In a wide variety of situations using the GCX mounting adapter for mounting the base station (order directly from GCX, part number PH-0042-80).
- On top of Series 50 IX/XM/XMO fetal monitors using the mounting brackets.

Contact your local Philips representative for additional cart mounting options.



Refer to the *Service Guide* for further details of how to mount your device.

Connecting the Base Station to a Fetal Monitor

You can connect the base station to either an Avalon FM20/30 or a Series 50 fetal monitor.

Avalon FM20/30

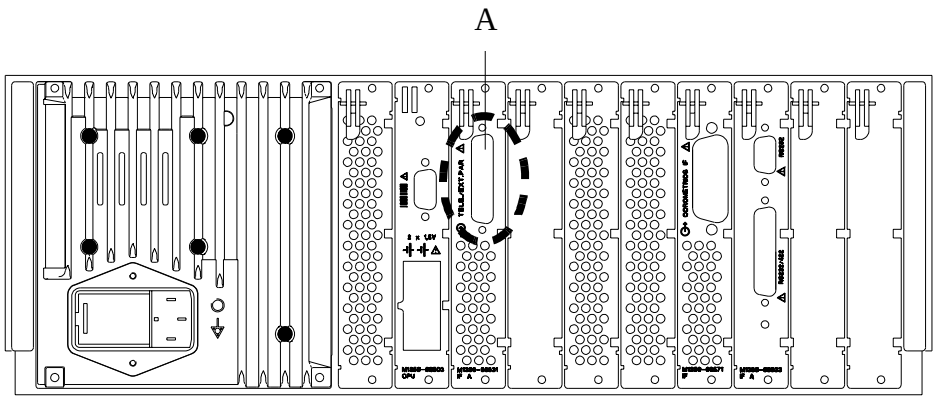
1 Connect the interface cable to the fetal monitor interface socket on the base station.

2 Connect the other end of the interface cable to any of the four fetal sensor sockets marked on the side of the monitor, highlighted in the picture.

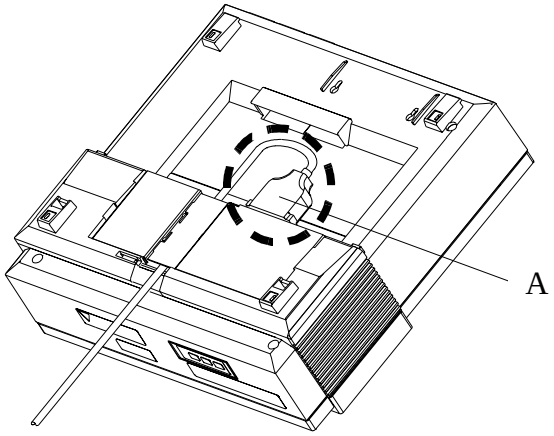
Series 50

1 Connect the interface cable to the fetal monitor interface socket on the base station.

2 Connect the other end of the interface cable to the telemetry socket **(A)** on the fetal monitor.



Series 50 IX/XM/XMO



Series 50 A and 50 IP/IP-2

Cordless Monitoring

When monitoring using cordless transducers, ensure that any wired fetal transducers are disconnected from the fetal monitor.

Changing to Wired Transducers

To use the fetal monitor with wired transducers, dock the cordless transducers and switch the base station to stand-by. You do not need to disconnect the telemetry interface cable.

How and When to Carry Out Tests

The following table defines which test or inspections need to be performed, and when they are required.

Test	Test or Inspection to be Performed	Test Required for Which Events?
Visual	Inspect the base station, transducers and cables for any damage. Are they free of damage?	Installation Preventive Maintenance
Power On	Power on the base station. Does the self-test complete successfully? (See page 18)	Installation Preventive Maintenance
Safety Tests (1) to (4)	Perform safety tests (1) to (4), as described in the *Service Guide,* if required by local regulations.	Installation Combining or exchanging system components
Performance	Perform the parameter test with all parameters (see page 36). Does this test complete without errors?	Installation Preventive Maintenance
System	Perform the system test according to IEC 60601-1-1, after combining equipment to form a system (see "System Test" on page 11).	Combining system components

For test and inspection information regarding repairs, upgrades and all other service events, refer to the *Service Guide*.

Safety Tests

Details of the safety tests and procedures required after an installation or an exchange of system components are described in the *Service Guide*.

WARNING Safety test requirements are set according to international standards, such as IEC/EN 60601-1 and IEC 60601-1-1, their national deviations, such as UL2601-1, CAN/CSA-C22.2 No. 601.1-M90 and No 601.1-S1-94, and specific local requirements.

The safety tests detailed in the *Service Guide* are derived from international standards but may not be sufficient to meet local requirements.

CAUTION The correct and accurate functioning of the equipment is ensured by the successful completion of the safety tests, performance test, and the system test.

Connecting the Base Station to AC Mains

WARNING This equipment is intended for use only within healthcare facilities. It is not suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network, which supplies buildings used for domestic purposes.

Do not use additional AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet without a separation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents.

Connect the base station to the AC mains using the supplied power cord.

Important for users in the USA: Before connecting the base station to a **240 V** AC mains supply system (instead of the usual 110 V), ensure that the system is a center-tapped single phase circuit.

If the AC power fails, the base station's power failure recovery system ensures that, after the return of power, the system resumes normal operation automatically.

System Test

After mounting and setting up a system, perform system safety tests.

What is a Medical Electrical System?

A medical electrical system is a combination of at least one medical electrical device and other electrical equipment, interconnected by functional connection or use of a multiple portable socket-outlet.

General Requirements for a System

After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN 60601-1-1. Compliance is checked by inspection, testing or analysis, as specified in the IEC 60601-1-1 or in this book.

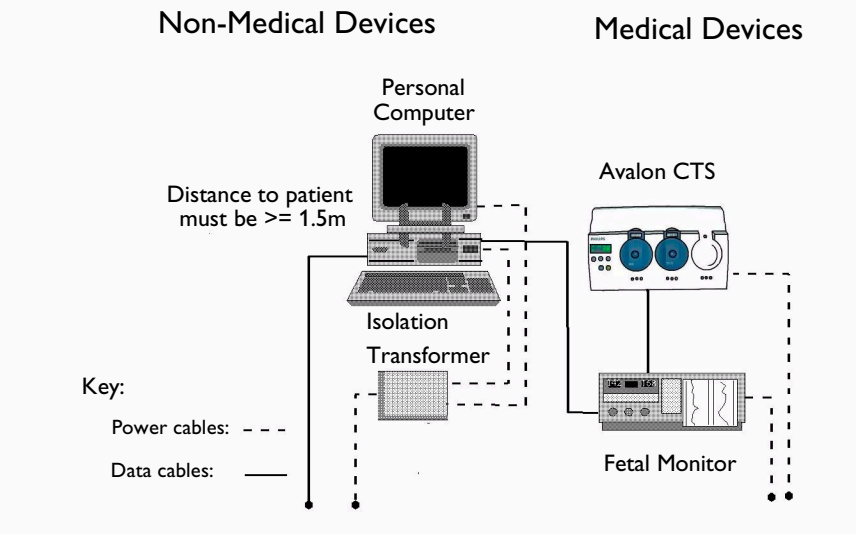
Medical electrical equipment must comply with the requirements of the general standard IEC/EN 60601-1, its relevant particular standards and specific national deviations. Non-medical electrical equipment shall comply with IEC and ISO safety standards that are relevant to that equipment.

Relevant standards for some non-medical electrical equipment may have limits for enclosure leakage currents higher than required by the standard IEC 60601-1-1. These higher limits are acceptable only outside the patient environment. It is essential to reduce enclosure leakage currents when non-medical electrical equipment is to be used within the patient environment.

WARNING Do not connect any devices that are not supported as part of a system.

System Example

This illustration shows a system where both the medical electrical equipment and the non-medical electrical equipment is situated at the patient's bedside.



WARNING Any non-medical device placed and operated in the patient's vicinity must be powered via an approved separation device.

If the personal computer (or any other non-medical electrical device) is situated outside the medically used room, you must take measures to reduce leakage currents, such as providing an additional protective earth, a non-conducting enclosure, or a separation device.

We highly recommend using a separation device whenever you connect non-medical electrical equipment.

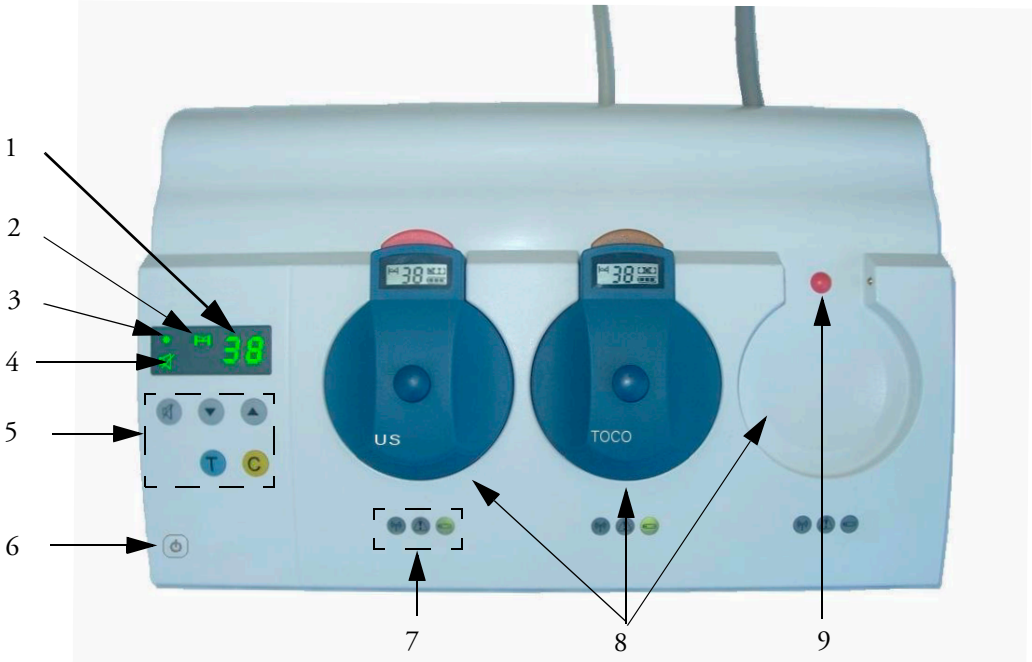
3

Basic Operation

This chapter describes the operational features of the Avalon CTS base station and transducers, including details of keys, displays and indicators.

Base Station

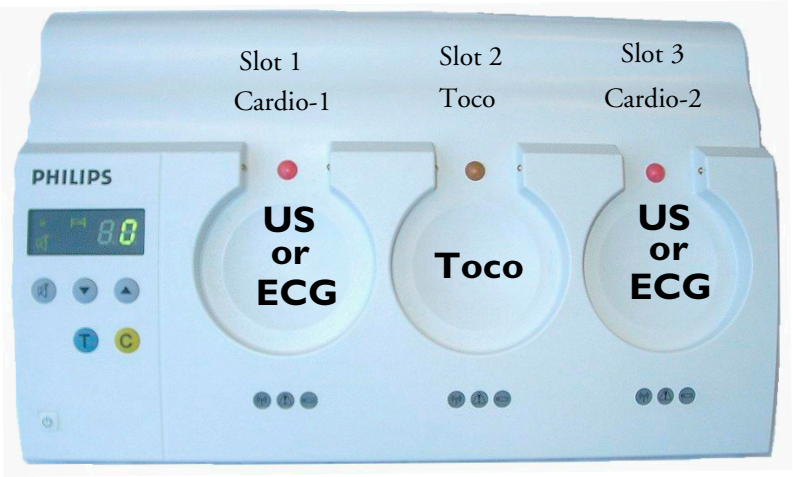
Your base station is shipped with a default bed label. This is the last two digits of the serial number. You can change this to any two-digit value between 00 and 99 (see page 55). We recommend that you give each base station in the hospital its own bed label. This lets you know to which base station an active transducer belongs. Normally, you would not have to change the bed label. The base station display and a registered transducer each display the bed label and bed symbol.



Item	Key or Symbol	Comments
1	**Numeric display**	**Two-digit display:** shows unique base station identification number (bed label), error and warning codes, configuration settings.
2		**Bed Symbol:** lights to show that the bed label (not error code) is currently shown in the numeric display.
3		**Power-on or Stand-by LED**. When the base station is connected to the mains, even in stand-by mode, transducer batteries charge continuously.
4		**Audible Alerts Off Symbol**: Indicates that audible alerts are off.
5		**Navigation Keys** to move through the configuration setting menus.
		**Function Key:** multi-function key for clearing blocked slots, acknowledging alarms, and confirming configuration changes.
		**Test Key:** press and hold down to test all system components and links to fetal monitor. Numerics are displayed/recorded on the fetal monitor.
		**Audible Alerts Off:** switches alerts on and off.
6		**On/Stand-by:** switches between stand-by (charge only) and On (operating mode).
7		**RF Link Indicator** Continuously on - transducer removed and active. Blinking together with the Warning Indicator - indicates that signal is too weak because patient is out of receiving area, or interference from stronger RF signal, or transducer has auto shutdown due to low battery.
		**Battery/Ready Indicator** Continuously on - indicates that the transducer is ready to use. It goes out as soon as you remove the transducer from its slot. Blinking together with the Warning Indicator shows that the battery of the active transducer which belongs to this slot is nearly empty.
		**Orange Warning Indicator** Slot, or the transducer which belongs to the slot, requires attention. Usually, this warning indicator comes on together with another blinking symbol, that is, the battery symbol or the RF link indicator.
8	**Docking Slots**	Store, charge and register transducers. Slot is color coded to match transducer color. Charges batteries when transducer is docked, even in stand-by.
9	**Docking slot color code indicator**	Red - US or optional ECG transducer with DECG or MECG adapter cable. Brown - Toco Neutral colored optional ECG transducer (without adapter cables attached) can go in Slot 1 or Slot 3.

Slot Arrangement

You can use transducers in the following slot positions:



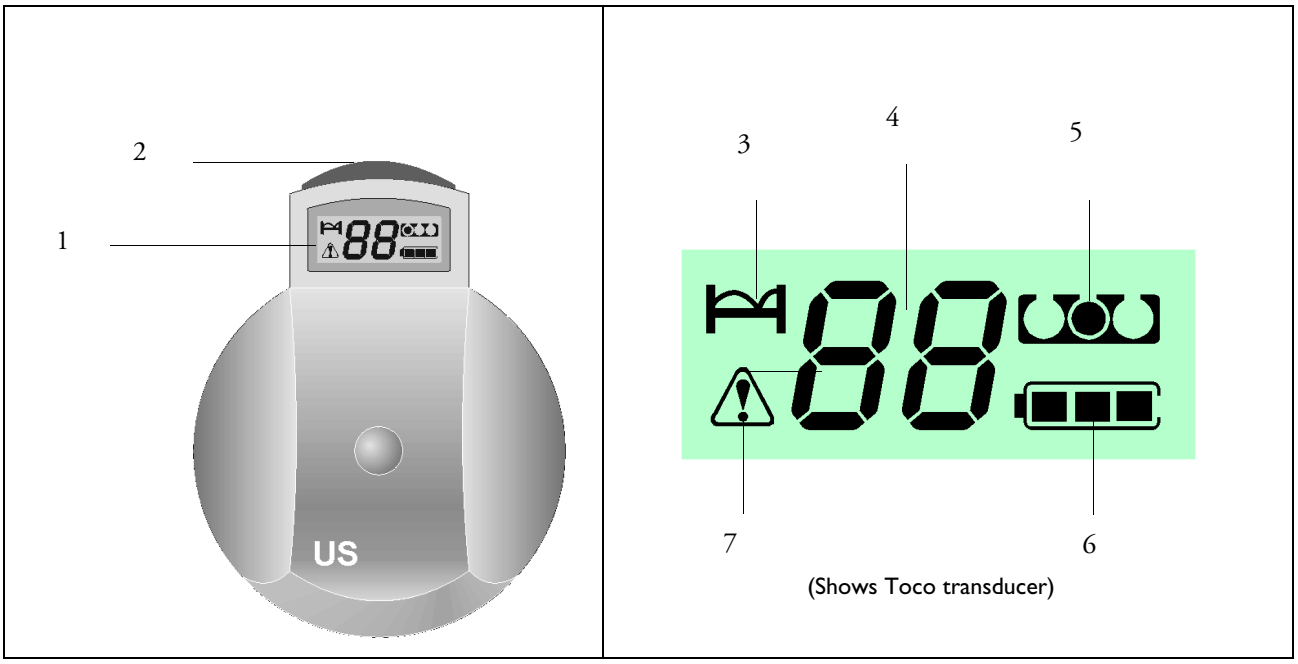
Twins monitoring is not possible.

The slot position indicator  on the transducer display (here showing Slot 2, Toco) always tells you in which slot to dock the active transducer after use.

CAUTION The base station generates a magnetic field. Do not store magnetic media (such as magnetic tapes and disks, identity cards or credit cards with magnetic strips) near to the base station, as the data may be damaged.

Transducers

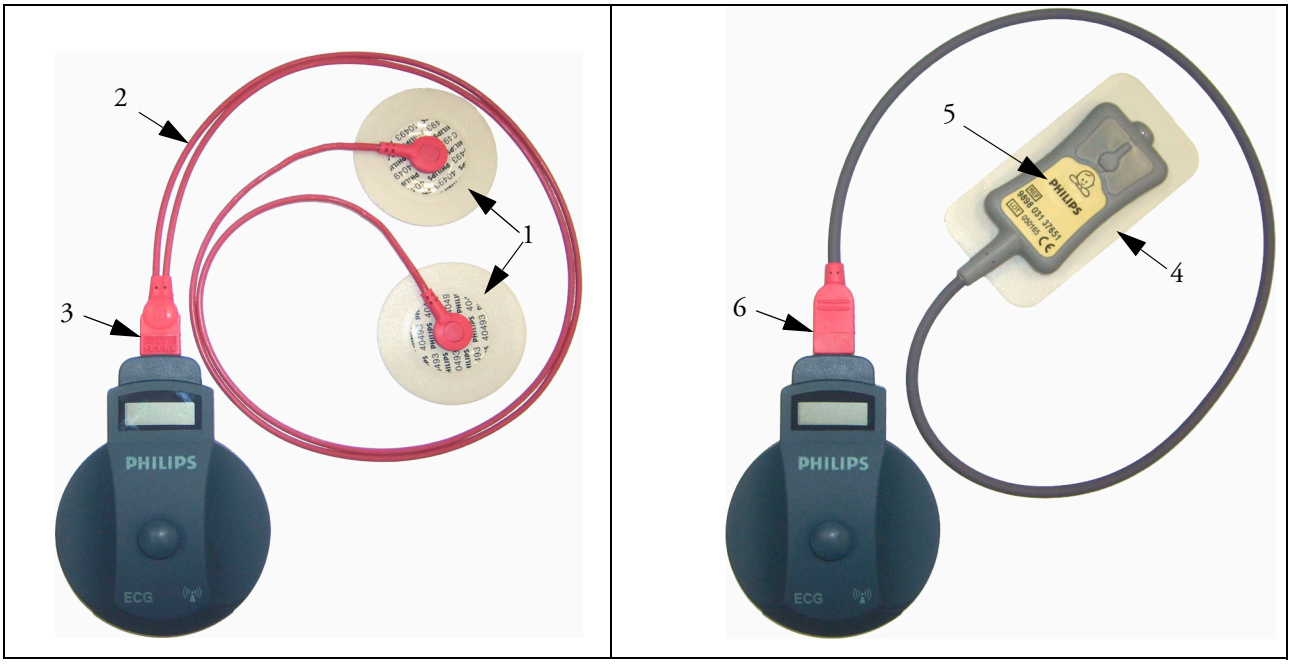
You can switch a transducer on, charge its battery, and register it to a base station only when it is docked in a base station slot.



(Shows Toco transducer)

Item	Key or Symbol	Comments
1	**Display**	Displays bed label, error codes, and operating conditions.
2	**Take-out aid**	Colored aid makes removal of transducer easier and helps you to ensure correct transducer placement in docking slot. Red for US, brown for Toco, blue for ECG (can go in any slot when adapter cables are not attached and the connector socket is color-coded red).
3		Indicates that the numeric display is showing the bed label.
4	**Numeric display**	Shows bed label number during normal operation, and if an error occurs, the error code number.
5		The filled dot indicates from which docking slot you removed the transducer, that is, the one to which the transducer is registered. Helps you to find the correct docking slot when you replace the transducer in the base station.
6		Indicates available battery capacity. Does not predict remaining operating time, as capacity of fully-charged batteries varies. If there is only one segment in the display, you have less than one hour's operating time left.
7		Indicates that the number shown in the numeric field is a warning code. During normal use you see only the bed symbol.

MECG and DECG Transducers



MECG (M2727A)	
1	Electrodes (40493E)
2	MECG Adapter Cable (M1363A)
3	Red ECG connector socket

DECG (M2727A)	
4	Disposable legplate electrode
5	DECG Adapter Cable
6	Red ECG connector socket

You can use standard MECG and DECG cables[3] with the M2727A ECG transducer. You can dock the ECG transducer without an MECG or DECG adapter cable in Slot 1 or Slot 3.

DECG/MECG measurement allows two lead ECG but no diagnostic MECG. ECG inputs are not defibrillator resistant.

WARNING **Shock hazard!**

NEVER dock an ECG transducer (either in DECG or MECG mode) in a base station slot if there are electrodes attached to the patient.

Do not use the ECG transducer under water. Although it is watertight, the functionality of the ECG transducer under water has not been validated for DECG and MECG measurements.

3.See “Approved Accessories and Supplies” on page 43 for compatible accessories.

4

Monitoring a Patient

See your fetal monitor's *Instructions for Use* for details of how to monitor fetal heart rate (FHR) and uterine activity, including how to apply transducers and transducer belts. Refer also to the instructions that accompany any accessories and supplies (for example, fetal scalp electrodes).

The device is intended to monitor one mother and her fetus.

What You Can Monitor

You can monitor:

- the fetal heart rate, using either ultrasound or direct ECG.
- uterine pressure, using the Toco transducer.
- maternal ECG using the ECG transducer.

While monitoring maternal ECG, you can monitor the fetal heart rate using ultrasound, but not using DECG, as the ECG transducer is already being used to monitor the mother's heart rate.

You cannot monitor two fetal heart rates simultaneously. When using a cordless ultrasound transducer to measure the fetal heart rate, note that you cannot use any other ultrasound transducer (whether cordless or wired) at the same time.

Flexible Monitoring

Your Avalon CTS provides highly reliable, cordless patient monitoring, giving the patient complete freedom of movement while being monitored. While this represents a major contribution to the comfort of the patient, be aware that when a patient is mobile, monitoring of the fetal heart rate may be slightly less reliable than a traditional wired system where patient movement is limited.

Radiated Transmission Power

The Avalon CTS provides all the benefits and flexibility of cordless operation, but does so with an effective radiated transmission power significantly less than that of a typical remote controlled child's toy.

WARNING **Explosion hazard**:

- Do not use in the presence of flammable anesthetics.
- Do not dry equipment using heating devices such as heaters, ovens (including microwave ovens), hair dryers and heating lamps.

Getting Ready to Monitor

WARNING **Always** check the condition of all parts of the system before use. Do not use any items that show signs of damage, or in the case of a transducer, moisture or condensation behind the LCD window.

For cordless monitoring, ensure that any wired fetal transducers are disconnected from the fetal monitor.

1. **Connect** the base station to the AC power supply.
2. **Press**  . The base station:
   - sounds a "welcome" beep
   - performs a display selftest, briefly switching on all display elements
   - displays the bed label together with the bed symbol
3. **Verify** that "TELE" is indicated on the fetal monitor.
4. **Wait** until the right-hand lamp of the slot  goes to green.
5. **Remove** the transducer.
   If theft protection is on, press  while removing the transducer. If you do not, the base station sounds an audible alert.
   The right-hand lamp of the slot  goes off, and the left-hand lamp  lights, and stays on as long as you monitor.
6. **Monitor** your patient.

Applying a Transducer

The transducers may pre-warm close to body temperature after they have been docked in a base station connected to AC mains power. This is normal. Please advise your patient before applying the transducer.

CAUTION Do not drop the transducers, as they may be damaged, and may no longer be watertight.

Do not use velcro belt adapter plates, as they can damage the transducers.

1. **Apply** the active transducers to the patient in accordance with the instructions given in the fetal monitor's *Instructions for Use*.

2 **Verify** that there is a good signal connection between the base station and the transducers.  should be continuously on. If it is blinking, in conjunction with the warning symbol then there is a reception problem. You see this   . See “Troubleshooting”.

3 **Verify** that: “TELE” is indicated on the fetal monitor.

Using Transducers

How measurements from cordless transducers are displayed depends on which fetal monitor you are using.

Avalon FM20/30 Monitors

Measurements from cordless transducers are displayed in the same way as those from wired transducers, except that the  symbol appears next to the measurement label, indicating that the measurement is being made by a cordless transducer. For details, refer to the monitor’s *Instructions for Use*.

Series 50 Monitors

The fetal heart rate always appears on the left Cardio channel display of the fetal monitor, whether you are using ultrasound or DECG. The MECG parameters are always assigned to the right Cardio channel of the fetal monitor. For details, refer to the monitor’s *Instructions for Use*.

Changing Between US and DECG Monitoring

If you have been monitoring using ultrasound and want to change to DECG, or the other way round, the following tables inform you what to do.

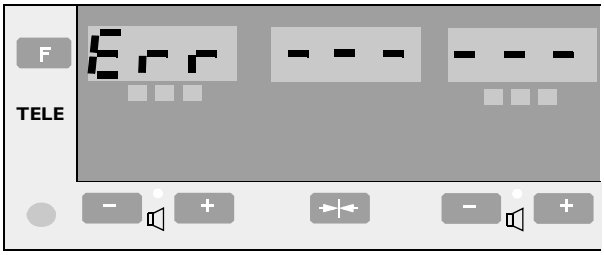
Changing from US to DECG monitoring	
1	Dock the US transducer.
2	Take out the ECG transducer when the lamp  for that slot is green.
3	Connect the DECG adapter cable and the fetal scalp electrode to the ECG transducer.
4	Start DECG monitoring.

Changing from DECG to US monitoring	
1	Disconnect the DECG adapter cable and the fetal scalp electrode from the ECG transducer.
2	Dock the ECG transducer.
3	Take out the US transducer when the lamp  for that slot is green.
4	Start ultrasound monitoring.

If two transducers for monitoring the FHR are active at the same time transmitting to the same base station, error message **E9** is shown on the base station display  . Clear the error by docking one of the transducers.

On an Avalon FM20/30 monitor, there are no parameters displayed until the error is cleared.

For Series 50 monitors, the FHR 1 field of the fetal monitor display shows **Err** alternating with the error number **9** which means invalid telemetry mode. Printing of the fetal heart rate trace on the CTG recorder is stopped, until the error is cleared.



Monitoring Multiple Fetal Heart Rates

Cordless monitoring of multiple fetal heart rates (twins or triplets) is not possible. If your fetal monitor supports multiple fetal heart rate monitoring, to monitor multiple fetal heart rates:

– Switch off the base station.
– Connect standard wired transducers to the fetal monitor, and continue monitoring.

After Monitoring

We recommend that you always leave the base station connected to AC mains.

Clean the transducers and dock them in the base station slot following the color code. You hear a 'click' when a transducer is properly seated.

Always disconnect ECG cables before docking ECG transducers.

If you want to monitor using wired transducers, switch the base station to stand-by (see below).

If you want to store the transducers outside the base station, or transport them, switch them off first. To switch off a transducer:

a. Switch the base station to stand-by (see below).

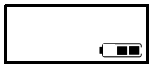
b. Remove the transducer.

Selecting Stand-by Mode

1 Return any active transducers to their associated docking slots.

2 Press ⏻. The base station display shows only the **power-on/stand-by** LED.

The transducer LCD shows only the battery symbol to indicate battery charging.



In stand-by mode, the base station:

– accepts any transducer in any operational state.
– accepts active transducers from another base station for charging. The other base station generates a signal loss alarm in this case.

Underwater Monitoring

WARNING **Never** immerse the **base station** in liquid. You must protect it against water sprays or splashes. Place the base station where there is no chance of contact with, or falling into water or other liquid.

Toco Baseline drift: The accuracy specified for baseline drift cannot be guaranteed for underwater usage. When using transducers under warm water the temperature increase causes a significant baseline change due to internal pressure increase. The depth under water at which the Toco transducer is used also has an effect on the Toco baseline, as the water pressure increases with depth. **After immersion, allow one to two minutes for the pressure to stabilize, then adjust the Toco baseline (between contractions), and check it frequently.**

Signal loss/interference: When using the transducers underwater, signal loss or interference may occur.

CAUTION Avoid the use of pulsating water jets in the bath or shower while monitoring, as these can be misinterpreted as an incorrect (or totally artificial) heart rate.

All Toco (M2725A) and ultrasound (M2726A) transducers are waterproof, fulfilling the watertight criteria of IP 68 (immersion to a depth of 0.5 m for five hours), according to IEC 60529. You can use them to monitor patients in a bathtub or shower.

Cordless transmission distances are shorter when monitoring under water. A metal bathtub is likely to further reduce the operating range.

About RF Signal Quality

Signal transmission can be disturbed when:

- the patient is out of range of the receiving area.
- there is interference from another, possibly stronger, RF signal (a broadcasting station, for instance).
- the patient is near material that absorbs electromagnetic waves (for example, metal-reinforced concrete, elevator doors) or the base station antenna is in an enclosed metal rack.

Other Monitoring Considerations

WARNING

- Ensure that the conductive parts of the fetal scalp electrode and the maternal legplate electrode do not contact other conductive parts, including earth.
- Indication of the heart-rate may be adversely affected by the operation of cardiac pacemaker pulses or by cardiac arrhythmias.
- During ambulant FHR monitoring, the chance of losing the signal or detecting the maternal heart rate is higher than during stationary monitoring. The frequency of the patient's walk may be detected, and mistaken for a FHR signal.
- Check the mother's pulse periodically during monitoring and compare this with the FHR signal. Beware of mistaking a "doubled" maternal heart rate for FHR. In the case of a dead fetus, there is a risk that the maternal heart rate is monitored and misinterpreted as the fetal heart rate. Therefore, the simultaneous monitoring of maternal heart rate (preferably, the maternal ECG) is encouraged.
- **Do not** interpret maternal movements as fetal movements.
- **Artifacts**: FMP artifacts are generated during fetal heart rate searching by changing the transducer position, therefore Philips fetal monitors enable the FMP only after detecting a valid heart rate signal for several seconds. Due to the likelihood of generating artifacts when the mother is mobile, when using a cordless transducer to measure the fetal heart rate, the monitor automatically sets the FMP to Off. You can enable it again manually should you wish, but you should be aware that FMP is not recommended when the mother is likely to move, and you should disable Fetal Movement Profile (FMP) at the fetal monitor (**FMP Off**) if the mother is walking.
- **Gaps** and maternal heart rate detection can occur:
  - if the transducer is not correctly positioned.
  - due to the pulsation of uterine blood vessels.
  - if the fetus moves.

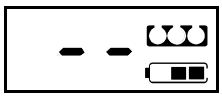
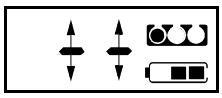
CAUTION Performing ultrasound imaging or Doppler flow measurements in conjunction with ultrasound fetal monitoring may cause false readings of FHR (recording of the trace may deteriorate).

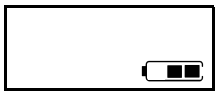
5

Transducer Behavior

Additional information regarding transducer behavior is given in this chapter.

Docking Transducers

When the base station is on...	
	1 When you dock a transducer in an active base station, it performs a test on itself, briefly switching on all display elements.
	2 The transducer display shows the slot indicator, battery symbol, and the two segment bars for a few seconds.
	3 The transducer is registered to the base station slot. The system gives the transducer a bed label identity. The two segment bars move up and down in the numeric display, as the system searches for a channel. Do not remove the transducer during registration (while the two segment bars are still visible), as this starts the transducer shutdown process.
	4 When the bed label on the transducer matches the base station, registration is complete, and you can now use the transducer. Depending on your system's configuration, you may notice that the transducer display sometimes reverts to the channel search stage shown in step 3. This happens when the system detects that a channel is already occupied or that there is some interference on that channel, and the system searches for an alternative, free channel. This is part of normal operation. The transducer is then registered as usual. If channel allocation is not possible due to lack of free channels, then the *Out of free channels* warning appears (see "Warnings and What To Do About Them" on page 25).

When the base station is in stand-by...	
	When you dock a transducer with the base station in stand-by, the transducer also switches to stand-by mode. The LCD shows only the battery symbol in the bottom right hand corner. This indicates that the batteries are charging.

Removing a Transducer from the Base Station

1 Ensure that the required transducers are ready to use (a bed label matching that of the base station is displayed in the LCD window).

2 When theft protection is off, pull up on the take-out aid to remove the transducer.

If theft protection is on:

Press C while removing the transducer. If you do not, the base station sounds an audible alert.

To silence the alert, either re-insert the transducer into its docking slot or disconnect the base station from the AC power. If you do not acknowledge it, the alert stops after one minute. See “Theft Protection Level” on page 56 for more details.

3 The transducer starts transmitting automatically and you can prepare to monitor straight away.

Switching Off Transducers

You should switch off transducers before storing or transporting them, so that the battery does not discharge.

To switch off a transducer:

1 Dock the transducer and switch the base station to stand-by.

2 Remove the transducer.

6

Troubleshooting

This chapter helps you recognize system error messages and problems you may encounter while using the system.

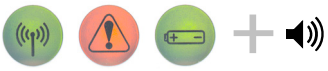
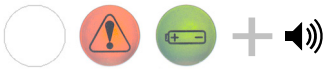
Warnings and What To Do About Them

Base Station Warnings:  blinks, alone or with lamps on either side.

 means lamp is either off or continuously on.

 means audible alert, if set. Press  to silence.

Transducer Warnings:  blinks together with the symbol representing the problem source.

If you get this warning...		...Do this...	Possible Reasons
...On base station...	...On transducer		
		Dock transducer to recharge battery, or replace transducer with a charged transducer. If problem persists, change transducer battery. (Also see *Service Guide*.)	Battery in the transducer is exhausted, leading to a shutdown and signal loss.
			
			
		Check that transducer is **active** and within range. Check antenna connection.	RF signal distortion. Transducer out of range. Automatic transducer shutdown.
		Press  for two seconds, to release blocked slot. See "Blocked Slots" on page 33.	Slot has lost RF signal with own active transducer. Active transducer from another base station is docked in this slot.

If you get this warning...		...Do this...	Possible Reasons
...On base station...	...On transducer		
 Example bed label	 Example bed label	This slot has an active transducer! Dock this one first to stop transmission. *Or* Return transducer to its own base station.	System rule: an active monitoring link can never be broken by docking the transducer in the wrong base station.
			
		Call Support.	Transducer registration is not possible due to lack of free RF channels.
		If active ECG transducer, connect cable. Place transducer in slot according to position indicated by the dot.	ECG transducer is waiting for you to connect a MECG or DECG adapter cable. Transducer is in the wrong slot. Color code does not match or an active transducer is placed in the wrong slot.
		As the transducer is not working, this error condition is indicated on the base station by the warning indicator. Take out the transducer and wait for shutdown, and then dock it again. Check transducer/docking slot contacts. Unplug system. Switch it on again. If problem persists, call Support.	Communication between base station and inserted transducer is not possible.
Theft Protection Alert 		Press  to silence.	Correct transducer removal procedure was not followed. See “Removing a Transducer from the Base Station” on page 24.

When base station is in stand-by mode:

- all audible warnings are disabled (except the theft protection if it is enabled).
- only the power on/stand-by LED (base station) and the battery indicator (transducer) are active.

Error Handling

Error messages appear if a malfunction causes any part of the system to become unusable, which may affect the safety and performance of the system.

When there is a fault in a transducer, the error code is shown in the transducer's LCD window. If the base station develops a fault, this is shown on the base station display. The only exception to this is when a transducer is completely inoperative. In this case, as it is not possible for the transducer to display the error, this is registered on the base station (the warning symbol  blinks).

It is highly recommended that the system is inspected by a qualified service engineer and the cause of the problem is identified and corrected.

Error Messages

Error* Number	Error and Type	Possible Reasons	Comments
E0	Unknown errors	Unclassified error.	The base station restarts every ten seconds and the system cannot be used. Refer to qualified service personnel.
E1	Device failure	General hardware or software device failure.	The system cannot be used. Refer to qualified service personnel.
E2	Transducer inoperative	Transducer hardware defect. This does not affect the operation of the system as a whole, but is restricted to the malfunctioning transducer.	Transducer related error is displayed on the base station, since the transducer display is not working. Try to reset the transducer. Switch the base station to stand-by, then remove the transducer to shut it down. Then dock it again and switch on the base station. If the transducer repeatedly fails to reset, replace the transducer. Refer defective transducer to qualified service personnel.
E3	Incompatibility error	Incompatible software revision.	Incompatibility error is displayed if an unsupported transducer is placed in an empty slot. Use only supported transducers.
E4	Battery charging not possible	Battery defect (charge level of the battery does not change).	Battery damage caused by excessive discharge. For tips on battery maintenance, see "Battery Care" on page 36. For battery replacement, refer to the *Instruction Sheet*, "Removing and Replacing the Transducer Battery" that accompanies the Battery Replacement Kit M2720-64001.
E5 to E8	Reserved for future implementation.	Debugging and service-related information.	Refer to qualified service personnel.
E9	Mode conflict	Two US, DECG or MECG transducers out of the same base station are active.	Twin or dual ECG monitoring is not supported.

*If you cannot solve the problem, refer to qualified service personnel.

Displaying the Error Messages

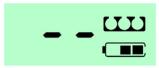
Error messages are prefixed with a letter **E** in the two-digit numeric field either on:

- the base station display (for serious errors or minor errors caused by the base station)

or

- the transducer displays.

Examples of how error messages are displayed:

Error Code	Error Type	Displays	
		Base station	**Transducer**
E1	Base station failure	 The base station will perform a cyclic reboot (every 10 seconds) and the system cannot be used.	 The transducer display may either show nothing or the pattern for unprogrammed transducers, depending on the program state at the time of error detection.
E1	Transducer failure	 The base station display shows the bed label. The warning light blinks. If the transducer is completely inoperative, its LCD is blank, so the only way to show this is on the base station. The warning symbol  blinks additionally in this case.	 If possible, the LC display shows the error number. Depending on the failure severity, the transducer may perform a cyclic reboot (every 10s).

Solving General Problems

Problem	Possible Causes	Solutions
The Telemetry Indicator Lamp on the fetal monitor does not light when the monitor and the base station are switched on.	Incorrect interface connection between the monitor and the base station.	Follow the instructions in *Service Guide* for details on how to connect the monitor to the base station.
	Faulty interface cable.	Replace interface cable.
Base station Power On Light does not light when the base station is switched on.	Power cable not plugged into the power supply.	Plug in and switch on.
	Insufficient AC power cable contacts (loose cable).	Check power cable connection. Refer to qualified service personnel.
	Fuses need replacing.	Replace fuses. See *Service Guide*.
Cordless monitoring is not possible.	Wired transducers are connected to the fetal monitor.	Unplug wired transducers from the fetal monitor.
Signal loss indicator on the base station is still lit when the transducer is active. 	Base station and transducer do not have the same bed label.	Use the bed label to identify to which base station the transducer belongs. See also “Blocked Slots” on page 33.
	Standard Antenna: Antenna not connected correctly.	Check antenna connection.
	Remote Antenna: Antenna cable not connected correctly to the base station.	Test the antenna system by bringing the transducer close to the base station. If the transmission is good, then the antenna system is not functioning properly. Refer the problem to qualified service personnel.
	Transducer is out of range.	Determine the effective operating range of the system in your particular environment, and inform the patient to stay within this area while monitoring takes place.
	Transducer is malfunctioning or damaged.	Replace the transducer.
	RF interference from an external source, such as a broadcasting station, or other telemetry devices.	Move the transducer away from the suspected source, to a different location, and check for improvement.
	Low battery power.	Charge batteries.
Battery Low Light lit on base station. 	Power in batteries is low. There is less than one hour of operating capacity left.	Charge the batteries. If battery performance is still not satisfactory after charging, carry out the battery check (see *Service Guide*).
All three lights blink on base station. 	Battery in the transducer is exhausted, leading to a shutdown and signal loss.	If necessary, change the battery in the transducer. (Refer to the *Instruction Sheet,* “Removing and Replacing the Transducer Battery” that accompanies the Battery Replacement Kit M2720-64001.)

Problem	Possible Causes	Solutions
The transducer is in the base station for charging, but the transducer display is blank.	Battery in the transducer is completely discharged.	Leave the transducer to charge for several hours. If the battery still fails to charge, replace the battery.
When the base station is switched on, the  lamp lights. After a few seconds, the  signal loss indicator flashes.	An active transducer was returned to the base station in stand-by mode, and the base station failed to disable the active RF link.	Press  for more than two seconds. We recommend you always leave the base station switched on, except when monitoring with wired transducers. Clean and dock transducers before disconnecting the base station from AC mains.
Suspicious heart rate sound can be heard (for instance, a flat or artificial heart rate).	Electromagnetic interference (EMI) from an external source, such as a radio or television broadcasting station, or other RF transmission.	Move the transducer away from the suspected source, to a different location, and check for improvement.
	Misplaced transducer.	Reposition transducer so that you get a green signal quality indicator on the fetal monitor.
Questionable ECG readings.	Broken cables, poor contacts, defective electrodes.	Check all connections, contacts and electrodes, and replace as necessary.
Toco baseline drift.	When using transducers under warm water the temperature increase causes a significant baseline change due to internal pressure increase. The depth under water at which the Toco transducer is used also has an effect on the Toco baseline, as the water pressure increases with depth.	After immersion, allow one to two minutes for the pressure to stabilize, then adjust the Toco baseline, and check it frequently.
Transducer belt button is broken.	Use of velcro belt adapter plates.	Replace belt button (qualified service personnel only). Do not use velcro belt adapter plates. Do not submerge transducers while monitoring or cleaning until the broken belt button is replaced.
General RF problems.	**For RF-related problems, use the Service Tool to find RF sources using the same frequency or frequency band (service personnel only). Then you can:** • **Exclude the "problem" frequency or band.** • **Use fixed frequencies instead of automatic frequency allocation.** **Note: the Service Tool cannot detect cellular phones.**	
Plausible readings that seem to come from a transducer that is not even attached to a patient.	Electromagnetic interference (EMI).	Use Service Tool (service personnel only) to locate sources of interference.

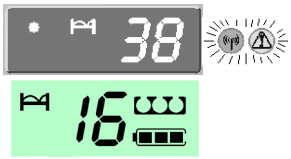
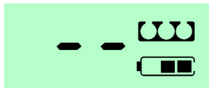
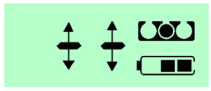
Problem	Possible Causes	Solutions
Poor/intermittent RF signal transmission.	If the problem is intermittent, cellular phones may be responsible.	Check for cellular phones in the vicinity.
	Electromagnetic interference (EMI).	Use Service Tool (service personnel only) to locate sources of interference.
Poor RF signal range.	Antenna connection/position suspect.	Check antenna connection and position/ orientation. Consider using an antenna system if greater range is needed. Consider another location which gives a better range.
Signal loss/interference.	Patient is outside of the receiving area.	Determine the effective operating range of the system in your location, and ensure the patient stays within this range.
	There is interference from another, possibly stronger, RF signal (a broadcasting station, for instance).	If this occurs on a regular basis, use the Service Tool (service personnel only) to locate the source of the interference.
	The patient is near material that absorbs electromagnetic waves (for example, metal-reinforced concrete, elevator doors) or the base station is in an enclosed metal rack.	In the case of structural materials, consider an alternative location if this is practical. If the base station is in an enclosed, metal case or rack, try it outside of the rack and check for improvement.
Signal loss immediately after transducer removal from slot when frequencies are fixed.	Channel already occupied, or RF interference is encountered.	If this occurs repeatedly, find and assign a new fixed frequency channel using the Service Tool (service personnel only).

Blocked Slots

There may be occasions when an active transducer stops transmitting a valid signal back to its home slot on the base station. Possible reasons include a transducer failure, or the transducer may be outside the operating range of the system. When a docking slot loses contact with a registered transducer, the base station generates a signal loss alarm, and blocks the slot. **The slot remains blocked, and cannot register another transducer until you clear it manually, or return the original, registered transducer if it is still active.**

Use the **`Clear Key`** C to force the base station slot to accept any docked transducers (according to color code). Pressing the **`Clear Key`** C with no transducer docked in the blocked slot will have no effect.

In this example, an active transducer coming from a different base station is docked in a blocked slot. The bed label of the base station is 38, the bed label of the active transducer is 16. The procedure describes how to clear a blocked slot so that it can allocate a channel and the bed label (38 in this example) to the transducer.

 Base station display Transducer display	1 In this example, initial displays look like this.
	2 Dock the transducer. The bed label and the warning symbol blink in the transducer display, indicating that the transducer is from a different base station.
	3 Press and hold down the C key for more than two seconds. This starts the sequence to clear the blocked slot (and any other slots that are blocked). The warning symbol and antenna symbol are switched off. The slot is now cleared.
	4 First, the transducer is switched to idle, with the two segment bars stable.
	5 Next, the transducer is registered to its base station slot. The system assigns the bed label to the transducer. The two segment bars move up and down in the numeric display, as the system searches for a free channel. Do not remove the transducer during registration (while the two segment bars are still visible), as this starts the transducer shutdown process.
	6 When the bed label on the transducer matches the base station, the transducer is ready for use.

To avoid blocked slots, switch off transducers before using them again in a different slot or base station. To switch off a transducer, dock it in a base station, switch the base station to stand-by, and remove the transducer (see “After Monitoring” on page 20).

7

Care and Cleaning

Use only the Philips-approved substances and methods listed in this chapter to clean or disinfect your equipment. Warranty does not cover damage caused by using unapproved substances or processes.

Philips makes no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. Consult your hospital's Infection Control Officer or Epidemiologist. For comprehensive details on cleaning agents and their efficacy refer to "Guidelines for Prevention of Transmission of Human Immunodeficiency Virus and Hepatitis B Virus to Health Care and Public-Safety Workers" issued by the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, Georgia, February 1989. See also any local policies that apply within your hospital, and country.

General Points

The transducers are sensitive instruments. Handle them with care.

Keep your base station and transducers free of dust and dirt. After cleaning and disinfection, check the equipment carefully. Do not use if you see signs of deterioration or damage. If you need to return any equipment to Philips, **always** decontaminate it first before sending it back in appropriate packaging. Observe the following general precautions:

- Always follow carefully and retain the instructions that accompany the specific cleaning and disinfecting substances you are using. Always dilute according to the manufacturer's instructions or use the lowest possible concentration.
- Do not allow liquid to enter the base station and transducer cases.
- Do not pour any liquid on the base station case.
- Do not immerse the base station in liquid.
- Do not allow a cleaning or disinfecting agent to remain on any of the equipment surfaces. Wipe residues off with a cloth dampened with water, after allowing the appropriate time for the agent to work.
- Never use bleach.
- Never use abrasive material (such as steel wool or silver polish).

Cleaning and Disinfecting

Clean and disinfect the base station and the transducers (including ECG adapter cables) after each use. Clean equipment before disinfecting. For other accessories, see “Cleaning and Disinfecting Monitoring Accessories” on page 37.

Clean the system components with a lint-free cloth, moistened with warm water (40°C/104°F. max) and soap, a diluted non-caustic detergent, tenside, or phosphate-based cleaning agent (see “Cleaning Agents” on page 36). Do not use strong solvents such as acetone or trichloroethylene. After cleaning, disinfect using only the approved disinfecting agents listed (see “Disinfecting Agents” on page 36).

CAUTION **Solutions:** Do not mix disinfecting solutions as hazardous gases may result.

Skin contact: To reduce the risk of skin irritations, do not allow a cleaning or disinfecting agent to leave residues on any of the equipment surfaces - wipe it off with a cloth dampened with water, after allowing the appropriate time to for the agent to work, or before applying to a patient.

Hospital policy: Disinfect the product as determined by your hospital’s policy, to avoid long term damage to the product.

Local requirements: Observe local laws governing the use of disinfecting agents.

Do not permit any liquid to enter the base station and avoid pouring it on the base station while cleaning. Ensure that the transducer battery drawer is firmly closed to prevent liquids from entering the transducer. Do not allow water or cleaning/disinfecting solution to enter the connectors at the rear of the base station, or those of the DECG/MECG transducers and adapter cables. Wipe around, not over, connector sockets.

Wash soiled reusable belts with soap and water. Water temperature must not exceed 60°C/140°F.

Cleaning Agents

Type	Base
Instrument Cleaner	Phosphates Tensides

Disinfecting Agents

WARNING To avoid the risk of damaging the base station, transducers and its accessories, do NOT use disinfectants containing additional active ingredients other than those listed.

Type	Base
Instrument Disinfectant	Glutaraldehyde up to 3.6%
Surface Disinfectant	Ethanol up to 70% 1- and 2- Propanol up to 70%

Cleaning and Disinfecting Monitoring Accessories

To clean, disinfect and sterilize reusable sensors, cables, leads, and so forth, refer to the instructions delivered with the accessory.

Do not allow a cleaning or disinfecting agent to leave residues on any of the equipment surfaces. Wipe residues off, after allowing the appropriate time to for the agent to work, with a cloth.

Sterilizing

Do NOT sterilize the base station and transducers, accessories or supplies unless otherwise indicated in the separate Instructions for Use that accompany the accessories and supplies.

8

Maintenance

WARNING **Shock hazard**: Do not remove the base station cover. Service may be performed by qualified service personnel only.

Grounding: Check each time before use that the system is in perfect working order and the base station is properly grounded.

CAUTION Failure on the part of the responsible individual hospital or institution employing the use of this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

The user or qualified service personnel should perform the following tasks routinely:

- Do not use any equipment that shows signs of cracks or other damage. **Before each use**, visually inspect the following:
  - the transducer and base station housings.
  - the Toco transducer membrane and ventilation knob.
  - the transducer's LCD window. If you see any moisture or condensation behind the LCD window, do not use the transducer.
  - the transducer battery drawer. Make sure it is firmly closed, and the sealing lip is in good condition.
  - cables and connectors to the fetal monitor.
- **After each use,** clean and disinfect the transducer and base station housings.
- **At least once a year**, check and if necessary exchange the transducer rechargeable batteries (qualified service personnel only).
- **At least once a month**, check the spring-loaded transducer contacts on the base station docking slots to ensure that the springs are still functioning adequately. When you apply pressure to the contacts, they should offer firm resistance, and spring back to their original position when you release the pressure.

Battery Care

Dock the transducers after use to charge the batteries (battery charging continues even in stand-by mode). This helps to ensure that the batteries remain in good condition, and that the transducers will be ready for use when you need them.

Transducers can remain docked indefinitely with no adverse effects to the battery. You can also recharge batteries at any time: if the battery is only partially discharged, the system tops up the charge to full, with no memory effect.

Do not store a transducer outside of the base station for long periods, as this can cause over-discharging and can damage the battery, shortening its life. If your battery is completely discharged, refer to “Solving General Problems” on page 29.

If you suspect that battery performance is below normal expectations, and especially if the operating time consistently falls below 16 hours, charge the batteries. If the operating time is still shorter than expected, run the battery check, and replace the battery if necessary. For battery replacement, please refer to the *Instruction Sheet* “Removing and Replacing the Transducer Battery”, that accompanies the M2720-64001 Battery Replacement Kit (intended for qualified service personnel).

Performance Assurance

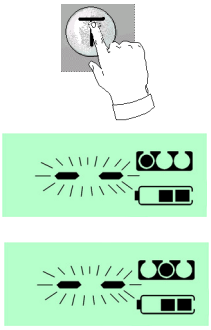
The transducers behave intrinsically like those in a wired system. The performance assurance tests for a conventional, wired system also apply to the Cordless system. Carry out performance checks as described in the *Service Guide*.

No calibration is necessary.

Parameter Test

This tests the entire signal path from the individual transducers connected via radio frequency, through the base station, to the fetal monitor with artificially generated test signals. We recommend you perform this test once a day, and whenever you doubt the reliability of the measurements.

	Base station display	In this example, one US transducer and one Toco transducer are docked. No other transducers are active. Initial displays appear as shown. The battery indicator is lit on the base station. The bed label is visible on both displays. The transducer display shows which slot is occupied.
	Ultrasound transducer display (slot 1)	
	Toco transducer display (slot 2)	



To start the test, with no transducers or alarms active:

1 Press and hold down T.
The test mode remains active for as long as you keep T pressed.
Battery charging stops, and the transducers behave like normal, active transducers. However, to differentiate between test mode and normal operation of a registered transducer, the two-digit numeric display in the LCD window shows the two segment bars (--) blinking.
If you remove a transducer while the parameter test is still in progress, the transducer shuts down.

2 Each transducer transmits an artificial signal, via the programmed RF channel, to its registered slot on the base station.

3 Check the values displayed by the fetal monitor to get an overview of the condition of the entire system. The following table specifies the signals that are generated during the test. As the mode of the ECG transducers is unknown to the base station (as it is configured outside of the base station), an ECG transducer is always mapped to the MECG mode. This avoids potential mode errors.

4 To stop the test, release the T key.

Expected signals generated during the system test:

Test Outputs	US Slot 1	US Slot 3	DECG* (Place in Slot 1)	TOCO (Place in Slot 2)	ECG transducer is in Slot 2	MECG* (Place in Slot3)
Value on fetal monitor LED display, Recorder, OB TraceVue Interface	190 bpm	170 bpm	200 bpm Note: Ensure there is no US transducer in slot 3 (Error 9 will appear)	 Signal with 30 units amplitude range and 20s period duration	An IUP reading appears on the fetal monitor. IUP measurements are not currently supported. Disregard any measurement you get.	120 bpm
Fetal monitor speaker	Artificial HR signal			N/A	N/A	"click"
Test tolerance**	+/- 2.5 bpm		+/- 2.5 bpm	+/- 10% period duration	N/A	+/- 2.5 bpm

*Test ECG transducers **without** the adapter cables attached.

**Signal is variable. Jitter should normally be within +/- 2.5 bpm. However, this could possibly be higher due to external factors, such as interference or the environment. On slot 1, the jitter can be higher than on slot 3.

Toco Transducer Ventilation Knob/Membrane

The transducer belt knob has an integral ventilation membrane that is important for the correct functioning of the Toco transducer. If the Toco baseline is not stable in air, check that the ventilation membrane is not congested, or directly blocked by ultrasound gel. Frequently check the condition of the belt/ventilation knob, and replace it if you see any signs of cracks or damage. To change the belt/ventilation knob, refer to the *Instruction Sheet* "Removing and Replacing the Transducer Belt Knob", that accompanies the M2720-64002 Knob Replacement Kit (intended for qualified service personnel).

Testing Alarms

Only technical alarms (for example, those for RF signal loss and battery status) are available on the Avalon CTS. Patient alarms are provided on the fetal monitor.

To test the functioning of the technical alarms:

1 Ensure audible alerts are enabled (see “Audible Alert Volume” on page 57).

2 Generate the alarm condition. For example, take the transducer out of range of the base station to generate signal loss, or let the battery capacity run down by leaving the transducer active.

3 Verify that the alarms are working. You should hear the audible alert and see:

–  flashing for signal loss.

–  flashing for the low battery warning.

Press C to silence the audible alert.

Example using the theft protection alarm:

1 Ensure that the transducers are docked.

2 Enable theft protection and set the protection level so that it is ON all the time (see “Theft Protection Level” on page 56).

3 Set the theft protection alert volume to Medium (see “Theft Protection Alert Volume” on page 56).

4 Remove the transducer (without pressing the C button) to generate the alarm. Press C to silence the alarm.

9

Accessories and Supplies

CAUTION Do not use accessories that are not approved by Philips. You may damage the equipment and this type of damage is not covered by warranty.

Information on Latex

All transducers and accessories are latex-free, unless indicated otherwise in the table below.

Approved Accessories and Supplies

Accessory		Part Number
Belts (contain latex)		M1562A
Waterproof Belts		M1562B
Disposable abdominal belts (case of 100)		M2208A
Ultrasound gel		40404-001
DECG Accessories: New Philips DECG Solution	DECG reusable legplate adapter cable (with flushing port)	9898 031 37651
	DECG leg attachment electrode for DECG legplate adapter cable	9898 031 39771
	DECG fetal scalp electrode: single spiral, worldwide availability	9898 031 37631
	DECG fetal scalp electrode: double spiral, Europe only. Not for USA	9898 031 37641
DECG Accessories: QwikConnect Plus™ Solution	DECG reusable legplate adapter cable (QwikConnect Plus™)	M1362B
	DECG leg attachment electrode for DECG legplate adapter cable	M1349A
	DECG fetal scalp electrode: single spiral, worldwide availability	15133E
	DECG fetal scalp electrode: double spiral, Europe only. Not for USA	15133D
MECG adapter cable		M1363A

Accessory		Part Number
MECG electrodes		40493E
ECG/AUX Transducer		M2727A
Telemetry interface cable	For connection to Avalon fetal monitors	M2731-60001
	For connection to Series 50 fetal monitors	M2720-61603
Antenna: all bands		0950-2028
Rectangular BNC connector		1250-0076
Battery exchange kit		M2720-64001
Transducer ventilation knob kit		M2720-64002

10

Specifications and Standards Compliance

US federal law restricts this device to sale by, or on the order of, a physician.

General

Environmental Specifications (Transducers and Base Station)		
Temperature Range	Charging	0°C to 45°C (32°F to 113°F)
	Operating	0°C to 45°C (32°F to 113°F)
	Storage (without battery)	-20°C to +60°C (-4°F to 158°F)
	Storage with battery	Depends on initial charge level and temperature (storage time decreases significantly at high (> 45°C/ 113°F) temperatures
Humidity Range	Operating	5% to 95% relative humidity @ 40°C/104°F
	Storage	5% to 85% relative humidity @ 50°C/122°F
Altitude Range	Operating	≤ 3000 m/9800 ft.
	Storage	≤ 15000 m/49000 ft.

Base Station

Base Station Specifications		
Receiver Unit		
Power	Supply Voltages	100 VAC to 240 VAC ± 10%
	Supply Frequency Range	50 Hz to 60 Hz
	Consumption	15 VA
Type of Protection Against Electrical Shock	Class I equipment	
Dimensions and Weight	Size mm/(in): width x depth x height	350 x 240 x 75 (13.8 x 9.5 x 3.0 in)
	Weight	2.5 kg/5.5 lbs without transducers
Input Sensitivity	Input Sensitivity	-110 dBm @ 30 dB Signal-to-Noise Ratio
Image Rejection	Image Rejection	> 80 dB
Ranges	Frequency Range	See Frequency options
	Receiving Range (line of sight)	approximately 100 m/300 ft.
Antenna	Input Impedance	50 Ω
Water Ingress Protection Code	IP X1 (protection only against vertically falling water drops)	

Base Station Specifications		
Monitor Interface		
Toco Output	Accuracy	± 0,5% per 100 mmHg (not including transmitter)
	Offset	± 5 Units (not including transmitter)
	Range	0 to 4 V
Voltage Range	US Voltage range	4 mVpp to 4 Vpp
	ECG Voltage range	0.1 Vpp to 4 Vpp

Transducers

Transducer Specifications		
General		
Shock Resistance	Withstands a 1m drop to concrete surface with possible cosmetic damage	
Usability Underwater	0.5m	
Water Ingress Protection Code	IP 68 (0.5m immersion for 5 hours)	
Dimensions and Weight	Size (diameter)	< 10 cm/3.94 in
	Weight	< 140 g/4.8 oz.
Battery	Type	Lithium Ion
	Capacity	> 16 hours
	Life	> 500 charge/discharge cycles (with new battery, at 25°C/77°F)
	Transducer Storage Time	≥ 1 year at 25°C/77°F (battery full)
		≥ 1 month at 25°C/77°F (battery empty)
	Recharging Time	100% charged ≤ 2,5 h
		66% charged ≤ 1 h
Degree of Protection Against Electrical Shock	Type CF	
RF Unit		
Nominal RF Output Power	0.1 mW ERP (typical)	
Carrier Frequency Range	See Frequency options	
Minimum Frequency Band Span Per Option	10 MHz	
Channel spacing	25 kHz (12.5 kHz Japan)	
Data rate	200 bits/s	
Modulation type	Analog	frequency modulation
	Digital	FSK 1.6 kHz and 2.4 kHz

Frequency Bands

Frequency Bands	
Frequency Range	**Major countries**
420 to 430 MHz, of which the following sub-ranges are used: – Band 1: 420.0625 to 421.0125 MHz – Band 2: 424.5000 to 425.9500 MHz – Band 3: 429.2625 to 429.7125 MHz	Japan
433.0500 to 434.7500 MHz	Most European countries, ISM band
608.0125 to 613.9875 MHz	US medical telemetry (WMTS) band, Canada, Australia and New Zealand

Availability in EU and EFTA Countries

At the time of printing, the device is approved for use in the following countries:

– EU: all countries except Cyprus, Denmark and Malta.

– EFTA: all countries except Liechtenstein.

Availability in additional countries may follow. Contact your local Philips representative for availability.

Frontends

Frontends			
US Frontend	US Intensity	Average output power	P = (3.3 ± 0.4) mW
		Peak-negative acoustic pressure	p_{-} = (27.4 ± 4.6) kPa
		Output beam intensity (I_{ob}) (= spatial average - temporal average intensity)	I_{sata} = (2.64 ± 0.83) mW/cm^2
		Spatial-peak temporal average intensity	I_{spta} = (7.0 ± 2.3) mW/cm^2
		Effective radiating area @ -6 dB	1.25 cm^2
	US Frequency		1 MHz
	US Signal range		3.5 µVpp to 350 µVpp @ 200 Hz
	US Burst Repetition Rate		3.2 kHz
	US LF Frequency Passband		110 to 450 Hz ± 20%
	FMP Signal Range (rti)		200 µVpp to 40 mVpp
	FMP Frequency Passband		10 to 90 Hz ± 20%
TOCO Frontend	Signal Range		0 to 127 units
	Offset Compensation (offset adjust at the fetal monitor)		+100 to -200 units
	Measurement Range		-100 to 300 units
	Resolution		0.25 units
	Baseline Drift due to Temperature Changes		1 unit/min/°C (free air)
			5 units/min/°C (underwater)

Frontends		
ECG Frontend	Type	Two Lead ECG
	Input Impedance	> 10MΩ @ 35 Hz
	CMRR	> 110 dB (with 51.1 kW || 47nF imbalance @ line frequency)
	Noise	< 4 µVp @ 25 kΩ input impedance
	Contact Potential	± 500 mV
	Inop Amplitude at open LA/ RA contacts	60 to 90 mV
	Inop Auxiliary Current	< 100 nA
	Input Voltage Range ECG	20 µVpp to 4 mVpp (66dB)
	Input DC tolerance	± 400 mV
	Dielectric Strength	1500 Vrms
	Frequency passband	0.7 to 80 Hz
	Defibrillator Protection	None
	ESU Protection	None
AUX Frontend	Communication Protocol	Serial, 1 start bit, 1 stop bit, 8 data bits, no parity
	Serial Communication Voltage Levels	Unipolar 3 V Receive: mark = 0V, space = ~3 V Transmit: mark = 0 V, space = high impedance (requires pull up resistor)
	Communication Speed	fixed 1200 Baud
	Max. Output Current for External Devices	100 mA electronically limited
	Output Voltage for External Devices	3 V ± 2%

Cables

Cable Type	Option Number	Part Number	Length
Avalon Fetal Monitor Interface Cable	M2720A option K30	M2731-60001	2.5 m approx.
Series 50 Interface Cable	M2720A option K50	M2720-61603	1.6 m approx.
Service Tool cable	-	M1360-61675	≤3.0 m
Power cable	-	Country dependent	≤2.4 m

Compatible Fetal Monitors

A list of compatible fetal monitors (including interfaces where applicable) is given in the following table.

Monitor / Interface	Parameter					Comments
	US	FMP	DECG	MECG	Toco	
M1350x with 531 IF	HR 1	-	HR 1	✓	✓	Only one FHR is transmitted.
M1350x with 536 IF	HR 1	✓	HR 1	✓	✓	Software revision A.04.01 or greater.
M1351A with 531 IF	HR 1	-	-	-	✓	No ECG processing. DECG mode generates “Err 9”.

Monitor / Interface	Parameter					Comments
	US	FMP	DECG	MECG	Toco	
M1351A with 531 E IF	HR 1	✓	-	-	✓	Software revision A.02.00 or greater.
M1353A with 531 IF	HR 1	-	HR 1	-	✓	Only one HR transmitted.
M1353A with 531 E IF	HR 1	✓	HR 1	-	✓	Software revision A.02.00 or greater.
M2702A (Avalon FM20)	FHR1	✓	-	HR only	✓	Maternal heart rate, no MECG wave.
M2703A (Avalon FM30)	FHR1	✓	DFHR	✓	✓	MECG including wave.
Key: ✓ = supported; - = not supported						

Standards Compliance

This section lists the standards and requirements to which the system is compliant. See also “Statement of Conformity” on page 55.

Safety

The device complies with the following safety standards:

- EN 60601-1:1990+A1:1993+A2:1995/IEC 60601-1:1988+ A1:1991+A2:1995
- EN 60601-1-1:2001/IEC 60601-1-1:2000
- UL2601-1
- CAN/CSA C22.2#601.1-M90
- JIS T 1001-1992
- JIS T 1002-1992
- AS 3200.1.0-1998

The cordless transducers are battery operated devices, applied parts (patient connectors) are Type CF.

Electromagnetic Compatibility (EMC)

The device and its accessories, listed in the accessories section, comply with the following EMC standards:

- EN/IEC 60601-1-2: 1993; EN/IEC 60601-1-2: 2001
- FCC 47 CFR Part 15 Subpart B
- ICES-001:1988

This device has been evaluated for electromagnetic compatibility (EMC) with the appropriate accessories according to the international standard for EMC with medical devices.

Take special precautions regarding electromagnetic compatibility (EMC) when using medical electrical equipment. You must operate your monitoring equipment according to the EMC information provided in this book and the Service Guide.

CAUTION The use of accessories, transducers and cables other than those specified may result in increased electromagnetic emissions or decreased electromagnetic immunity of the device.

Medical electrical equipment can generate electromagnetic interference and may also be interfered with by other equipment, even if the other equipment is compliant with EN 60601-1-2 emission requirements.

CAUTION The device should not be used adjacent to, or stacked with equipment other than a Philips fetal monitor.

Radio frequency (RF) interference from nearby transmitting equipment can degrade performance of the device. Before using the device, assess the electromagnetic compatibility of the device with surrounding equipment.

Fixed, portable and mobile radio frequency (RF) communications equipment can also affect the performance of medical electrical equipment.

WARNING Do NOT use cordless/mobile phones or any other portable RF communication system within the patient vicinity, or within a 1.0 m radius of any part of the fetal monitoring system.

See your service provider for assistance with the minimum recommended separation distance between RF communications equipment and the product.

EMC Testing

CAUTION Fetal parameters, especially ultrasound and ECG, are sensitive measurements involving small signals, and the monitoring equipment contains very sensitive high gain front-end amplifiers. Immunity levels for radiated RF electromagnetic fields and conducted disturbances induced by RF fields are subject to technological limitations. To ensure that external electromagnetic fields do not cause erroneous measurements, it is recommended to avoid the use of electrically radiating equipment in close proximity to these measurements.

During the test program the device was subjected to international EMC tests. During most of the testing, no anomalies were observed. Some reduced performance was observed with the EN/IEC 61000-4-6 Conducted RF Immunity test, and the EN/IEC 61000-4-3 Radiated RF Immunity test.

– EN/IEC 61000-4-3 specifies that the product must be subjected to a field of 3 V/m over a frequency range of 80 MHz to 2.5 GHz with no degradation of performance.
– EN/IEC 61000-4-6 specifies that the product must be subjected to a field of 3 V over a frequency range of 150 kHz to 80 MHz with no degradation of performance.

However, some frequencies were detected where the immunity level was below the IEC 60601-1-2 test level, affecting the ultrasound and ECG parameters. For these points the radiated test field was reduced to the level at which the display and recorder output returned to normal. These frequencies have been grouped into ranges in the following table, and within each frequency range, the worst-case immunity level is given.

Conducted RF Immunity Test EN/IEC 61000-4-6			
IEC 60601-1-2 Test Level over 150 kHz to 80 MHz	**Frequency Range (where Immunity Level is below IEC 60601-1-2 Test Level at certain frequencies)**	**Known Sources of Electromagnetic Interference within the Frequency Range**	**Worst Case Immunity Level within Frequency Range**
3.0 V	0.5 MHz - 1.6 MHz	Medium Wave (AM) radio stations	0.1 V @ 1.003 MHz

Radiated RF Immunity Test EN/IEC 61000-4-3			
IEC 60601-1-2 Test Level over 80 MHz to 2.5 GHz	**Frequency Range (where Immunity Level is below IEC 60601-1-2 Test Level at certain frequencies)**	**Known Sources of Electromagnetic Interference within the Frequency Range**	**Worst Case Immunity Level within Frequency Range**
3.0 V/m	270 MHz - 320 MHz	Commercial radio service (for example, aircraft radio)	1.1 V @ 277.499 MHz
	890 MHz - 960 MHz	Commercial radio service (for example, GSM cell phones, WLAN)	0.1 V @ 925.010 MHz

Reducing Electromagnetic Interference

The product and associated accessories can be susceptible to interference from other RF energy sources and continuous, repetitive, power line bursts. Examples of other sources of RF interference are other medical electrical devices, cellular products, information technology equipment, and radio/television transmissions.

When electromagnetic interference (EMI) is encountered, for example, if you can hear spurious noises on the fetal monitor's loudspeaker, attempt to locate the source. Assess the following:

- Is the interference due to misplaced or poorly applied transducers? If so, re-apply transducers correctly according to directions in this book or in the Instructions for Use accompanying the accessory.
- Is the interference intermittent or constant?

- Does the interference occur only in certain locations?
- Does the interference occur only when in close proximity to certain medical electrical equipment?

Once the source is located, there are a number of things that can be done to mitigate the problem:

1 Eliminating the source. Turn off or move possible sources of EMI to reduce their strength.

2 Attenuating the coupling. If the coupling path is through the patient leads, the interference may be reduced by moving and/or rearranging the leads. If the coupling is through the power cord, connecting the system to a different circuit may help.

3 Adding external attenuators. If EMI becomes an unusually difficult problem, external devices such as an isolation transformer or a transient suppressor may be of help. Your Service Provider can be of help in determining the need for external devices.

Where it has been established that electromagnetic interference is affecting physiological parameter measurement values, a physician or personnel authorized by a physician should determine if it will negatively impact patient diagnosis or treatment.

System Characteristics

The phenomena discussed above are not unique to this system but are characteristic of patient monitoring equipment in use today. This performance is due to very sensitive high gain front end amplifiers required to process the small physiological signals from the patient. Among the various monitoring systems already in clinical use, interference from electromagnetic sources is rarely a problem.

Electromagnetic Emissions

Emissions test
Radio Frequency (RF) emissions in accordance with CISPR 11: Group 1, Class B
Harmonic emissions IEC 61000-3-2: Class A
Voltage fluctuations and flicker IEC 61000-3-3

Radio Requirements

The device complies with the following radio requirements standards:

- EN 300 220-3:2000, EN 300 220-1:2000
- FCC 47 CFR Part 15 Subpart C and Part 95 (WMTS)
- RSS-210
- IEEE C95.1-1999

WARNING This equipment generates, uses and radiates radio-frequency energy, and if it is not installed and used in accordance with its accompanying documentation, may cause interference to radio communications.

Operation of this equipment in a residential area may cause interference, in which case the users, at their own expense, must take whatever measures may be required to correct the interference.

FCC Compliance (USA only)

The transmitter and receiver devices in the system are subject to radio frequency interference from radio and television stations licensed as primary users. In the event of suspected radio frequency interference with your device, contact your Philips service provider. Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this equipment not expressly approved by Philips Medical Systems may cause harmful interference, and void your authority to operate this equipment.

The system complies with part 15 of the Federal Communications Commission (FCC) Rules. Operation is subject to the following two conditions:

1 This device may not cause harmful radio frequency interference to a primary licensed user (radio and television stations), and

2 This device must accept any interference received from a primary licensed user, including interference that may cause undesired operation.

Canadian Radio Equipment Compliance (Canada Only)

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

For operation in 608-614 MHz:

This telemetry device is only permitted for installation in hospitals and health care facilities. This device shall not be operated in mobile vehicles (even ambulances and other vehicles associated with health care facilities). The installer/user of this device shall ensure that it is at least 80 km from the Penticton radio astronomy station (British Columbia latitude: 49° 16’ 12”, longitude: 118° 59’ 56” W). For medical telemetry systems not meeting this 80 km separation (for example, the Okinagan Valley, British Columbia) the installer/user must coordinate with and obtain the written concurrence of the Director of the Penticton radio astronomy station before the equipment can be installed or operated.

For operation outside the 608-614 MHz range:

Contact your local Industry Canada office, as a license is required.

To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding.

The term “IC:3549C-M2720A” before the certification/registration number only signifies that Industry Canada technical specifications were met.

Environment

Before operation, make sure that the base station is free from condensation. This can form when equipment is moved from one building to another, and is exposed to moisture and differences in temperature.

Use the system in an environment which is reasonably free from vibration, dust, corrosive or explosive gases, extremes of temperature, humidity, and so forth. It operates within specifications at ambient temperatures between 0 and +45°C. Ambient temperatures that exceed these limits can affect the accuracy of the system, the transmitter radio frequency transmission, and can damage the components and circuits.

The system can be stored at ambient temperatures between -20°C and +60°C.

The transducers are watertight to a depth of 0.5 m (rated IP 68).

The base station is protected against vertically falling water drops only (rated IP X1 according to IEC 60529).

ESU, MRI and Defibrillation

WARNING The fetal/maternal monitors are NOT intended for use during defibrillation, electro-surgery, or MRI. Remove all transducers, sensors, and accessories before performing electro-surgery, defibrillation, or MRI, otherwise harm to the patient or the user can result.

This equipment has **not** been tested with defibrillators.

Symbols on the System

	This attention symbol indicates that you should consult the Instructions for Use (this guide), and particularly any warning messages.
	Power-On/Stand-by Switch
	Power-On/Stand-by Indicator
	Equipotential Terminal This symbol identifies terminals which are connected together, bringing various equipment or parts of a system to the same potential. This is not necessarily earth potential. The value of potentials of earth may be indicated adjacent to the symbol.
	Protective Earth Terminal This symbol identifies the terminal for connection to an external protective earth system.
	Antenna input symbol.
	Service socket symbol.
	This symbol appears on the device adjacent to the CE mark and defines Class 2 radio equipment per Radio and Telecommunications Terminal Equipment Directive 1995/5/EC.
IPX1	Ingress Protection code according to IEC 60529. Base station is rated IP X1 (protection against *vertical* water drops only).
IP68	Ingress Protection code according to IEC 60529. All transducers are rated IP 68 (protection against dust, access to hazardous parts, and the effects of continuous immersion in water to a depth of 0.5 meter for five hours).

	Type CF equipment.
	Identifies the year and month of manufacture.
	Symbol indicating separate collection for waste electrical and electronic equipment.

Protective Earth

WARNING **Shock hazard**: The power receptacle must be a three-wire grounded outlet. Never adapt the three-prong plug from the power supply or accessory to fit a two-slot outlet. If the outlet only has two slots, make sure that it replaced with a three-slot grounded outlet before attempting to operate the monitor.

Maximum Input/Output Voltages

Service Socket	Maximum voltage of ±12V.
Socket to Fetal Monitor	Maximum voltage of ±12V.
Power Input Socket	100-120V ~ or 220-240V ~
Transducer Contacts	Maximum Voltage of +12V.
ECG Transducer	Maximum Voltage of +3V.

Statement of Conformity

Philips Medizin Systeme Boeblingen GmbH declares that the Avalon CTS Cordless Fetal Transducer System (M2720A), consisting of transmitters (transducers), receiver (base station) and various antenna components, is in conformity with the essential requirements of the European Medical Devices Directive 93/42/EEC and the Radio and Telecommunications Terminal Equipment Directive 1999/5/EC.

The ! symbol defines Class 2 radio equipment per the Radio and Telecommunications Terminal Equipment Directive 1995/5/EC for which Member States may apply restrictions on putting the device into service or placing it on the market. This device is intended to be connected to the publicly available interfaces (PAI) for use throughout the EEA.

11

Glossary

This section is intended as a concise reference for the different possible states of the base station and transducers, common conditions of operation, and the terminology used in this book.

Base Station

Active - base station is On, and is being used for monitoring.

Active slot - an empty slot that is receiving signals from an active transducer.

Bed label - two-digit identification number allocated to a base station. Each base station in the same hospital should have a unique bed label. This appears in the displays of both the base station and the transducers during normal operation. It shows:

- to which base station the transducer belongs
- that the transducer is ready for use.

The bed label is only for identification purposes, and does **not** represent a measurement of any parameters, nor is it an indicator of the actual RF channel used.

Blocked slot - a docking slot that has lost signal contact with its transducer, but remains in signal loss state ('blocked') until you clear it. To clear the blocked slot, use the **`Clear Key`** C (see "Blocked Slots" on page 31).

Color coding - see "Docking slot".

Docking slot - slot in base station in which a transducer 'lives'. Transducers and docking slots follow the usual Series 50 fetal monitoring color coding:

- red for US or optional ECG transducer with DECG or MECG configuration cable plugged in (Cardio1 and Cardio2 channels)
- brown for Toco.

Off - no AC mains power (unit is unplugged from AC socket), no functions operative.

On - AC mains power is on, all functions operative.

Registration - when you dock an active transducer into an active base station slot, it is automatically registered to that slot. The system automatically assigns a new, unique, radio frequency to the transducer. A registered transducer displays a bed label, and is ready to use.

RF - radio frequency used for radio transmission. See also "RF channel".

RF channel - radio frequency channel by which the transducer is connected to the base station.

RF link - the radio frequency connection between a base station slot and a registered transducer. This does the same job as the cables of a traditional, wired system.

Stand-by - unit is plugged into AC mains socket, but not switched on. Power is supplied for some functions, such as battery charging, but base station is not ready to use until switched on.

Transducers

Active transducer - one that is ready and removed from its slot with RF link to the base station (normal monitoring mode).

Color coding - take-out aid (see page 14) is colored as follows:

- Red - for US
- Brown - for Toco
- Blue - for optional ECG transducer (with red connector)

Docking - putting a transducer into a slot on the base station. We recommend that you dock an active transducer in the same slot from which you removed it.

ECG transducer - one with blue take-out aid (note that the socket for the adapter cable is red). Can be docked in any slot when adapter cables are not attached. Accepts DECG or MECG adapter cables, also colored red.

Home slot - the slot to which a transducer is registered and where it should be docked after use.

Off - no functions operative, display is blank.

Ready - a transducer that is registered to a base station slot, displays the bed label, is ready to use, but still docked in the base station. See “Using Transducers” on page 19.

Registered transducer - see “Registration”.

Stand-by mode - you can charge a transducer in any base station slot, display shows battery symbol.

Shutdown - process of switching a transducer off.

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Advanced Configuration

Base station configuration settings that you can change during use are described in this chapter. Information on changing all other settings is in the *Service Guide*.

Bed Label

To change the bed label (in this example, from 16 to 38):

Step	Action	Display looks like...
1	Press the two arrow keys simultaneously. The bed label blinks, the two-digit display goes blank.	
2	Press C once. The two-digit bed label display blinks.	
3	Press to decrease the bed label number, or to increase it (as in this example).	
4	Press C to accept the new bed label and return to normal operation.	
or	To retain the old bed label and return to normal operation, either press the key or wait 15 seconds.	

Theft Protection Level

When theft protection is on, the base station generates an audible alarm if you do not follow the correct procedure for removing a transducer. The system is shipped with the theft protection off.

To set the theft protection level ('C' setting C1):

Step	Action	Display looks like...
1	Press the two arrow keys ▼ ▲ simultaneously. The bed label blinks, the two-digit display goes blank.	
2	Press ▲ once to enter the 'C' settings. 'C' flashes in the display.	
3	Press C. 'C1' appears, and the '1' will blink.	
4	Press the C key again. Two-digit display shows the current setting (1.0=OFF [default], 1.1=ON only while base station is in stand-by, 1.2=ON all the time).	
5	Press ▼ or ▲ to change the protection level.	
6	Press C to accept the new theft protection level and return to normal operation.	

Theft Protection Alert Volume

To change the theft protection alert volume ('C' setting C4):

Step	Action	Display looks like...
1	Press the two arrow keys ▼ ▲ simultaneously. The bed label blinks, the two-digit display goes blank.	
2	Press ▲ once to enter the 'C' settings. 'C' flashes in the display.	
3	Press C. 'C1' appears, and the '1' blinks.	

Step	Action	Display looks like...
4	Press ▲ three times to increase 'C' setting to 4.	
5	Press C. Two-digit display shows the current setting (4.1=Low, 4.2=Medium [default], 4.3=High).	
6	Press ▼ or ▲ to set the desired volume level.	
7	Press C to accept the new theft protection alert volume level and return to normal operation.	

Audible Alert Volume

You can choose to enable or disable the audible alerts, or vary the volume level. To set the alarm volume level ('C' setting C2):

Step	Action	Display looks like...
1	Press the two arrow keys ▼ ▲ simultaneously. The bed label blinks, the two-digit display goes blank.	
2	Press ▲ once to enter the 'C' settings. 'C' flashes in the display.	
3	Press C. C1 appears, and the '1' blinks.	
4	Press ▲ once to increase 'C' setting to 2.	
5	Press C. Two-digit display shows the current setting (2.0=OFF, 2.1=Low, 2.2=Medium [default], 2.3=High).	
6	Press ▼ or ▲ to set the desired volume level.	
7	Press C to accept the new audible alert volume level and return to normal operation.	

Key Click Volume

To enable or disable the key click, or change its volume ('C' setting C3):

Step	Action	Display looks like...
1	Press the two arrow keys simultaneously. The bed label blinks, the two-digit display goes blank.	
2	Press once to enter the 'C' settings. 'C' flashes in the display.	
3	Press C. C1 appears, and the '1' blinks.	
4	Press twice to increase 'C' setting to 3.	
5	Press C. Two-digit display shows the current setting (3.0=OFF, 3.1=Low, 3.2=Medium [default], 3.3=High).	
6	Press or to set the desired volume level.	
7	Press C to accept the new key click volume level and return to normal operation.	

Acoustical Alarm Default

To change the default setting (ON or OFF) for the acoustical alarm ('C' setting C5):

Step	Action	Display looks like...
1	Press the two arrow keys simultaneously. The bed label blinks, the two-digit display goes blank.	
2	Press once to enter the 'C' settings. 'C' flashes in the display.	
3	Press C. C1 appears, and the '1' blinks.	

Step	Action	Display looks like...
4	Press ▲ four times to increase 'C' setting to 5.	
5	Press C. Two-digit display shows the current setting (5.0=OFF, 5.1=ON [default]).	
6	Press ▼ or ▲ to set the desired acoustical alarm default.	
7	Press C to accept the new acoustical alarm default and return to normal operation.	

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Disposal

WARNING To avoid contaminating or infecting personnel, the service environment or other equipment, make sure the equipment has been appropriately disinfected and decontaminated before disposal at the end of its useful life.

Base Station:

- There is no metal molded into the plastic parts and no metal sprays on the plastic.
- All plastic parts with a weight greater than 10g (0.35 ounces) are marked with the ISO code for identification.
- The sheet metal chassis uses only one kind of steel.
- You can disassemble the base station as described in the *Service Guide*.
- The display window of the base station can be removed by application of force.
- The aluminium shield on the receiver board must be removed before Printed Circuit Board (PCB) recycling.
- Recycle PCBs according to local laws.

Transducer:

- The transducer housing is a two-component molding of polycarbonate (white) and polyurethane (blue) and has one brass thread-insert molded in.
- The Lithium-Ion battery should be removed[1] and recycled according to local laws and regulations.
- All labeling on the transducer has been done by laser, so no separation is necessary before recycling.
- The housing is glued together, disassembly for recycling is possible by applying force.
- The transducer PCB is glued to the lower half of the transducer housing.
- Recycle the PCB and the liquid crystal display according to local laws.

1. A special tool is available.

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